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SAMSUNG ELECTRONICS

LEAD-FREE

TO   : IT Solution

DATE   : Nov. 11, 2011.

SAMSUNG TFT-LCD
MODEL NO. : LTN140KT08-8

NOTE : Extension code [-8**]
        → LTN140KT08-8**
        Surface type [**Anti-Glare**]

 Any modification of Spec is not allowed without SEC's permission
The information described in this SPEC is preliminary and can be changed without prior notice.

APPROVED BY : _____

PREPARED BY :   *Jina Kim*

Application Engineer Group

SAMSUNG ELECTRONICS CO., LTD.

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SPEC REVISION HISTORY

Date	Revision No.	Page	Summary
Jun. 22, 2011	P00	All	The preliminary specification of LTN140KT08-8 was issued first.
Oct. 07, 2011	A00	All	The approval specification of LTN140KT08-8 was issued first.
Oct, 24, 2011	A01	P23 P31~35	Outline dimension was updated as final ME design. Appendix was updated .
Nov, 11, 2011	A02	P7 P23	Optical characteristic was updated. Outline drawing was updated due to the change of flange height .

CODE REVISION HISTORY

Date	Model.	Revision No.	Summary	MP or EOL
Jun. 22, 2011	LTN140KT08	801	Basic model	From Oct, 2011 ~

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GENERAL DESCRIPTION

DESCRIPTION

LTN140KT08 is a color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as switching devices. This model is composed of a TFT LCD panel, a driver circuit and a backlight unit. The resolution of a 14.0" contains 1600X900pixels and can display up to 16.2M colors. 6 O'clock direction is the optimum viewing angle.

FEATURES

- High contrast ratio
- HD+ (1600 x 900 pixels) resolution
- Fast Response
- LED Back Light with embedded LED Driver
- DE (Data enable) only mode
- 3.3V LVDS Interface
- Onboard EEDID chip
- Green product (RoHS compliant)
- APS function
- 6bit-FRC

APPLICATIONS

- Notebook PC
- If the usage of this product is not for PC application, but for others, please contact SEC

GENERAL INFORMATION

Item	Specification	Unit	Note
Display area	309.6H) x 174.15(V) (14.0" diagonal)	mm	
Driver element	a-Si TFT active matrix		
Display colors	16.2M		
Number of pixel	1600 x 900	pixel	
Pixel arrangement	RGB vertical stripe		
Pixel pitch	0.1935(H) x 0.1935(V) (TYP.)	mm	
Display Mode	Normally white		
Surface treatment	Haze 25%, Hard-Coating 3H		Anti-glare

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Mechanical Information

| Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal (H)	322.0	322.3	322.6	mm	
	Vertical (V)	186.8	187.1	187.4	mm	Module ~ Module
		198.8	199.1	199.4	mm	Outline with PCB
	Depth (D)	-	-	3.8	mm	Body area (1)
		-	-	4.0	mm	PCB cover (2)
	Weight	-	-	330	g	

Note (1) Measurement condition of outline dimension

. Equipment : Bernier Calipers

. Push Force : 750g·f

1. ABSOLUTE MAXIMUM RATINGS

1.1 ENVIRONMENTAL ABSOLUTE RATINGS

Item	Symbol	Min.	Max.	Unit	Note
Storage temperate	TSTG	-20	60	°C	(1)
Operating temperate (Temperature of glass surface)	TOPR	0	50	°C	(1)
Shock (non-operating)	Snop	-	240	G	(2),(4)
Vibration (non-operating)	Vnop	-	2.41	G	(3),(4)

Note (1) Temperature and relative humidity range are shown in the figure below.

95 % RH Max. (40 °C $\geq$ Ta)

Maximum wet - bulb temperature at 39 °C or less. (Ta > 40 °C) No condensation

Relative Humidity (%RH)

(40,90)

Operating Range

(50,50.4)

(60,27.7)

Storage Range

Temperature (°C)
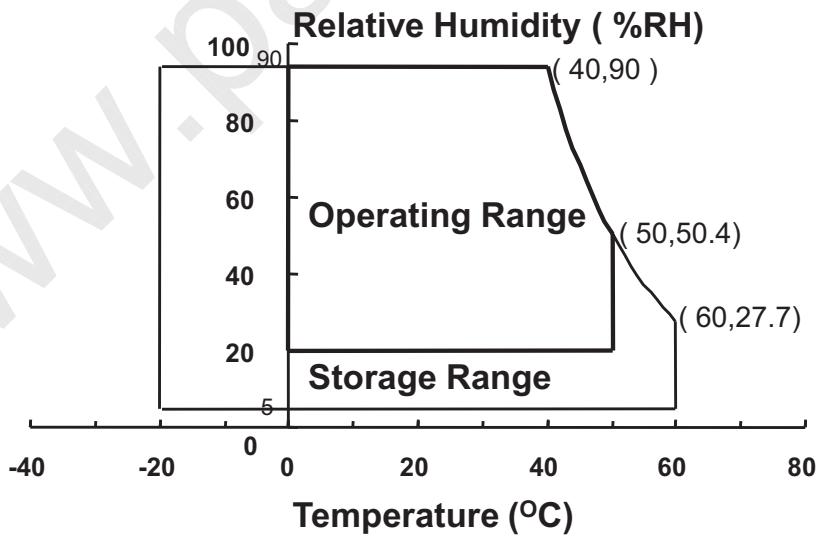
(2) 2ms, half sine wave, one time for ±X, ±Y, ± Z.

(3) 5 - 500 Hz, random vibration, 30min for X, Y, Z.

(4) At testing Vibration and Shock, the fixture in holding the Module to be tested have to be hard and rigid enough so that the Module would not be twisted or bent by the fixture.

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1.2 ELECTRICAL ABSOLUTE RATINGS

(1) TFT LCD MODULE

V_{DD} =3.3V, V_{SS} = GND = 0V

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V_{DD}	V_{DD} - 0.3	V_{DD} + 0.3	V	(1)
Logic Input Voltage	V_{IN}	V_{DD} - 0.3	V_{DD} + 0.3	V	(1)

Note (1) Within Ta (25 $\pm$ 2 °C)

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2. OPTICAL CHARACTERISTICS

The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods shown in Note (5). Measuring equipment : TOPCON SR-3

* Ta = 25 ± 2 °C, V_{DD}=3.3V, fv= 60Hz, f_{DCLK} = 50.2MHz

Item		Symbol	Condition	Min.	Typ.	Max	Unit	Note
Contrast Ratio (5 Points)		CR		300	-	-	-	(1), (2), (5)
Response Time at Ta (Rising + Falling)		T_{RT}		-	16	25	msec	(1), (3)
Average Luminance of White (5 Points)		$Y_{L,AVE}$		255	300	-	cd/m²	(1), (4)
Color Chromaticity (CIE)	Red	R_X	Normal Viewing Angle ϕ = 0 θ = 0	TYP -0.03	0.575	TYP +0.03	-	(1), (5) SR-3
		R_Y			0.345			
	Green	G_X			0.330			
		G_Y			0.574			
	Blue	B_X			0.160			
		B_Y			0.120			
	White	W_X			0.313			
		W_Y			0.329			
Viewing Angle	Hor.	θ_L	CR ≥ 10 At center	-	45	-	Degrees	(1), (5) SR-3
		θ_R		-	45	-		
	Ver.	ϕ_H		-	15	-		
		ϕ_L		-	30	-		
13 Points White Variation		δ_L		-	-	1.6	-	(6)
Color Gamut		CG		-	45	-	%	

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Note 1) Definition of Viewing Angle : Viewing angle range(10 ≤ C/R)

Normal Line
$\phi = 0^o, \theta = 0^o$

θ_L

θ_R

ϕ_L ϕ_H

$\theta_L = 90^o$ x

y

12 O'clock direction
$\phi_H = 90^o$

6 O'clock direction
$\phi_L = 90^o$ y'

x'

$\theta_R = 90^o$
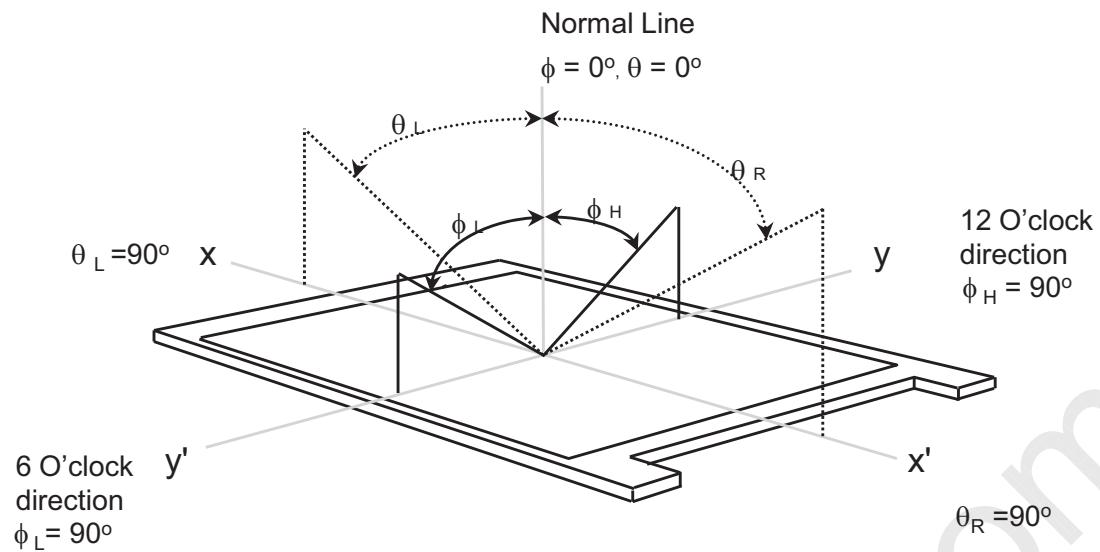
Note 2) Definition of Contrast Ratio (CR) : Ratio of gray max (Gmax) ,gray min (Gmin) at 5 points(4, 5, 7, 9, 10)

$$CR = \frac{CR(4) + CR(5) + CR(7) + CR(9) + CR(10)}{5}$$

Points : ④ , ⑤ , ⑦ , ⑨ , ⑩   at the figure of Note (6).

Note 3) Definition of Response time :

Display data   White(TFT OFF) | Black(TFT ON) | White(TFT OFF)

T_R T_F

Optical Response

100%
90%

10%
0%

Time
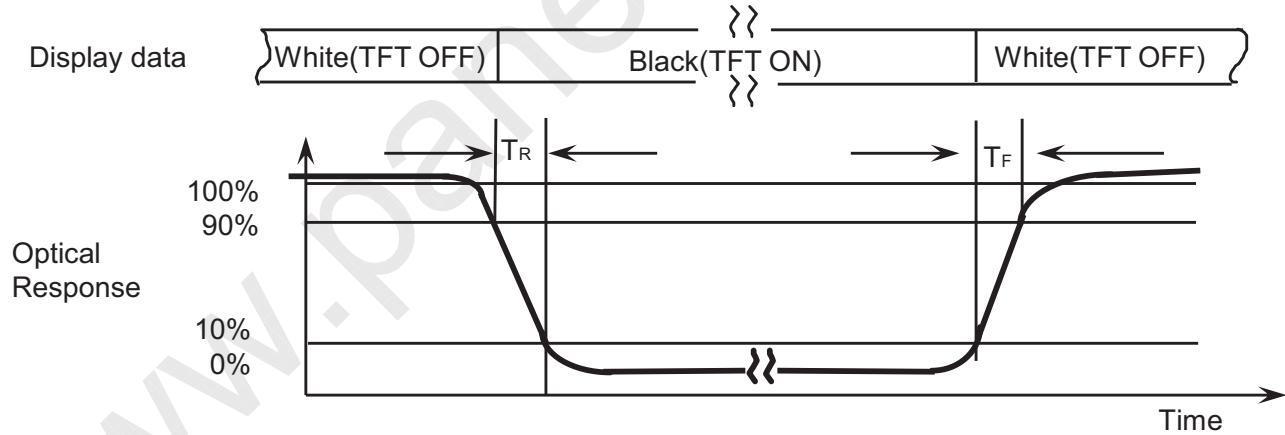
Note 4) Definition of Average Luminance of White : measure the luminance of white at 5 points.

25%   50%   75%

VIEW AREA

Average Luminance of White ($Y_{L,AVE}$)

$$Y_{L,AVE} = \frac{Y_{L4} + Y_{L5} + Y_{L7} + Y_{L9} + Y_{L10}}{5}$$

⑩   ⑨   25%

⑦   50%

⑤   ④   75%
(lines)

○ : test point

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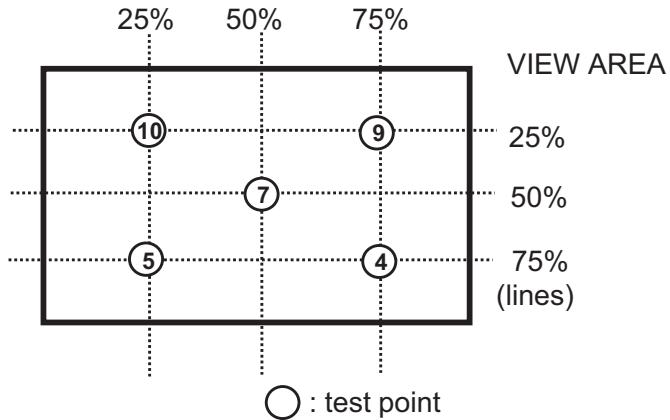
Note 5) After stabilizing and leaving the panel alone at a given temperature for 30 min , the measurement should be executed. Measurement should be executed in a stable, windless,and dark room. 30 min after lighting the backlight. This should be measured in the center of screen. (Under SET LED current)
Environment condition : Ta = 25 ± 2 °C

Photo-detector
(TOPCON SR-3)

Field = 2°

50 cm

TFT-LCD module

LCD panel

Center of the screen

[Optical characteristics measurement setup]
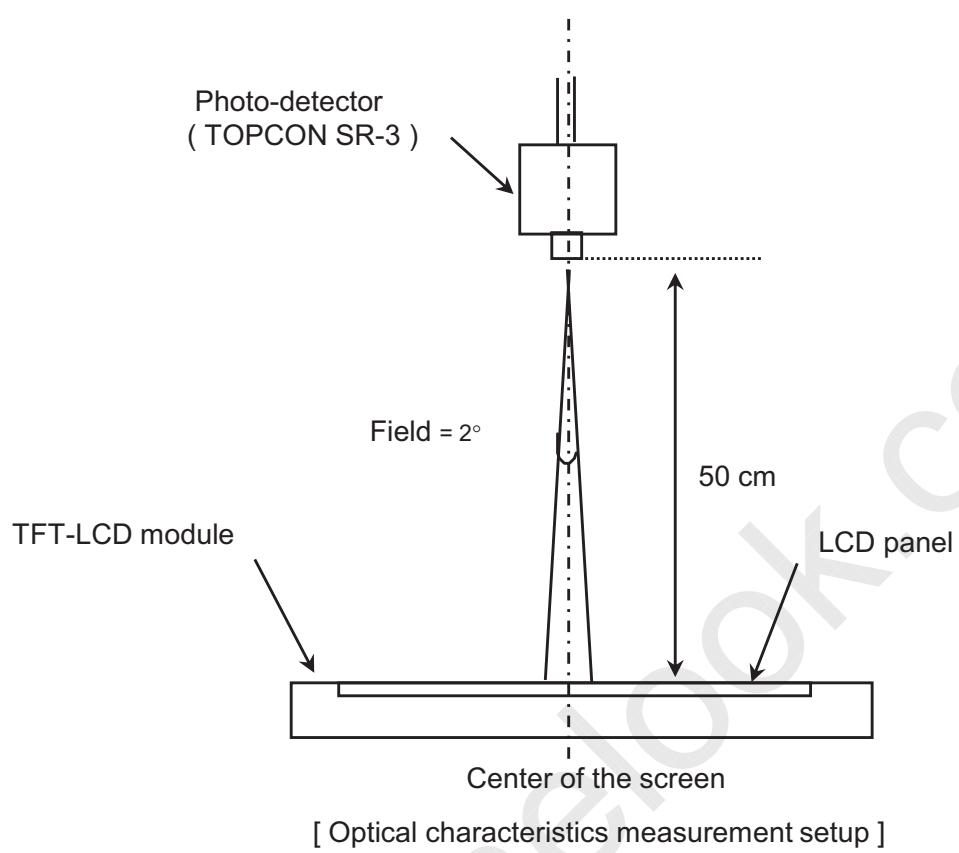
Note 6) Definition of 13 points white variation (δ L), CR variation(CVER) [① ~ ⑬]

$$\delta_L \ = \ \frac{\text{Maximum luminance of 13 points}}{\text{Minimum luminance of 13 points}}$$

10mm

10mm

25%   50%   75%

10mm

13   12   11

10   9

25%

8   7   6

50%   ◯ : test point

5   4

75%

3   2   1

10mm

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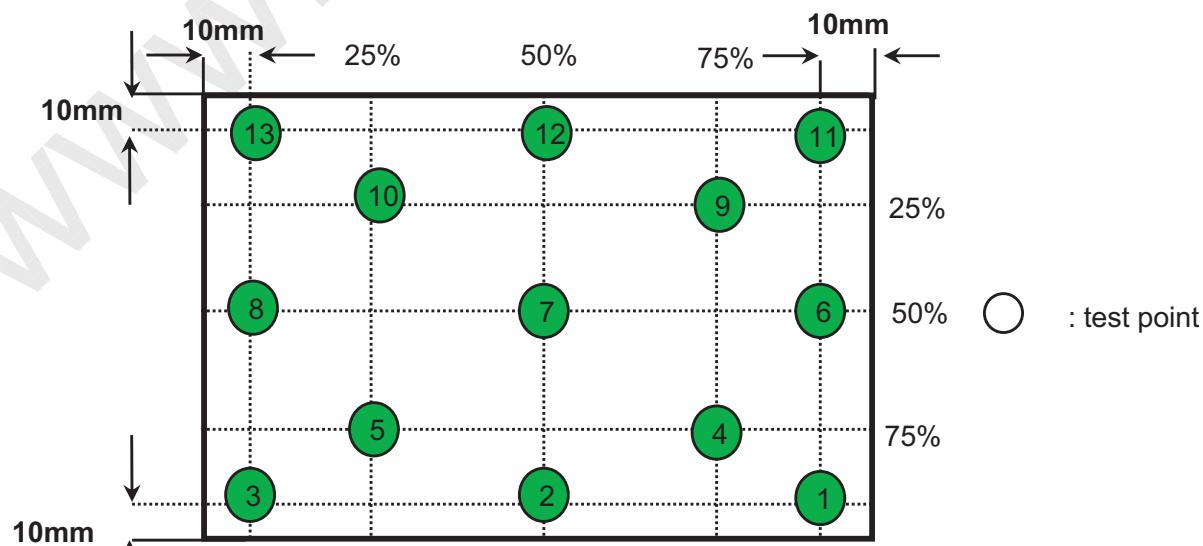
3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE

Ta= 25 ± 2°C

Item		Symbol	Min.	Typ.	Max.	Unit	Note
Voltage of Power Supply		V_{DD}	3.0	3.3	3.6	V	
Differential Input Voltage for LVDS Receiver Threshold	High	V_{IH}	-	-	+100	mV	V_{CM} = +1.2V
	Low	V_{IL}	-100	-	-	mV	
Vsync Frequency		fv	-	60	-	Hz	
Main Frequency		f_{DCLK}	49.3	51.9	54.5	MHz	2CH
Rush Current		I_{RUSH}	-	-	1.5	A	(4)
Current of Power Supply	White	IDD	-	330	-	mA	(2),(3)*a
	Mosaic		-	330	-	mA	
	Black		-	330	-	mA	(2),(3)*b
	V.Stripe		-	540	600	mA	(2),(3)*c

Note (1) Display data pins and timing signal pins should be connected.(GND = 0V)

(2) fv = 60Hz, f_{DCLK} = 50.2MHZ, V_{DD} = 3.3V , DC Current.

(3) Power dissipation pattern

*a) White Pattern

*b) Mosaic Pattern

Display Brightest Gray Level →

Display Darkest Gray Level

*c) Black

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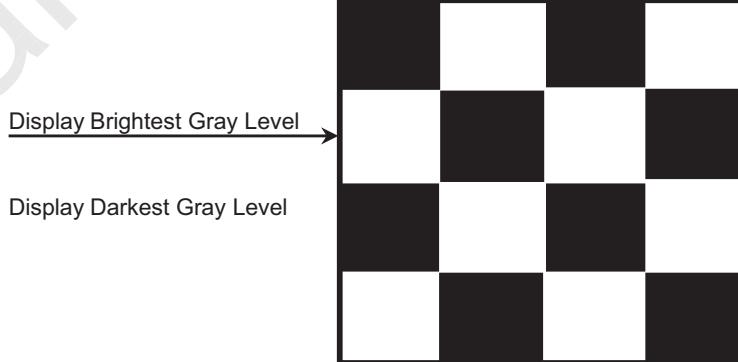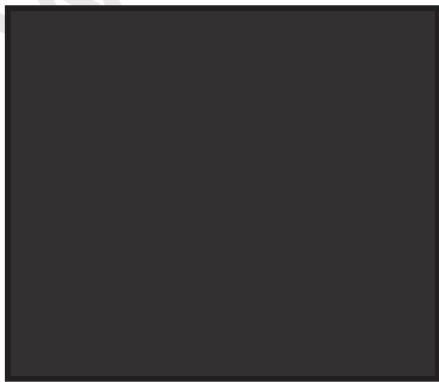
d) V.Stripe
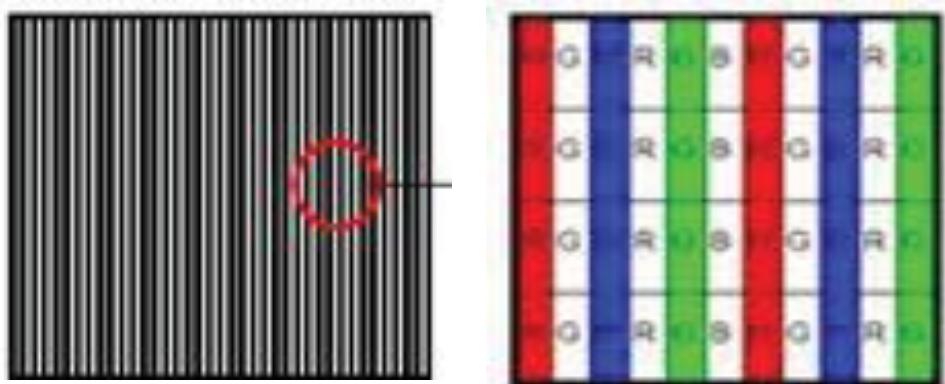
4) Rush current measurement condition

3.3V

M1
2SK1059

V_{DD} (LCD INPUT)

FUSE

R1
47K

C1
1uF

CONTROL SIGNAL
(HIGH to LOW)

R2
1K

M2
2SK1399

12V

R3
47K

C2
10000pF

C3
1uF

V_{DD} rising time is 470us

0.9V_{DD}

3.3V

0.1V_{DD}

GND

470us

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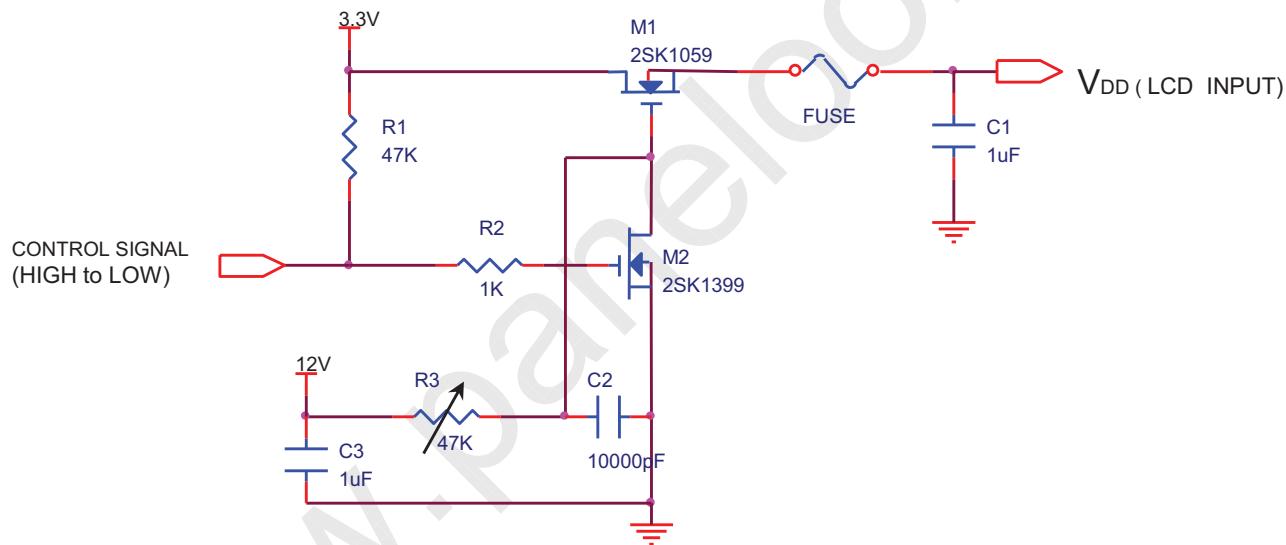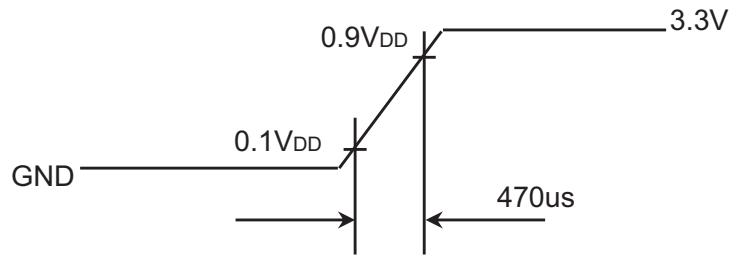
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3.2 BACK-LIGHT UNIT

Ta= 25 ± 2 ℃

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED Forward Voltage	VF	3.0	3.2	3.4	V	
LED Array Voltage	VP	18	19.2	20.4	V	VF X 6 LEDs
LED Counts		-	48	-	EA	
Operating Life Time	Hr	10,000	-	-	Hour	(1)

Note (1) Life time (Hr) of LEDs can be defined as the time in which it continues to operate under the
         condition Ta= 25 ± 2 ℃ and LED current by system.
         When the brightness becomes 50% or lower than the original.

3.3 LED Driver

External LED Driver Used.

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4. BLOCK DIAGRAM

4.1 TFT LCD Module

Legend:
- → Video Signal
- → Control Signal
- → VCOM
- → LED Power&signal
- → DVDD
- → AVDD
- → Von/Voff
- → Gamma
- → Feedback
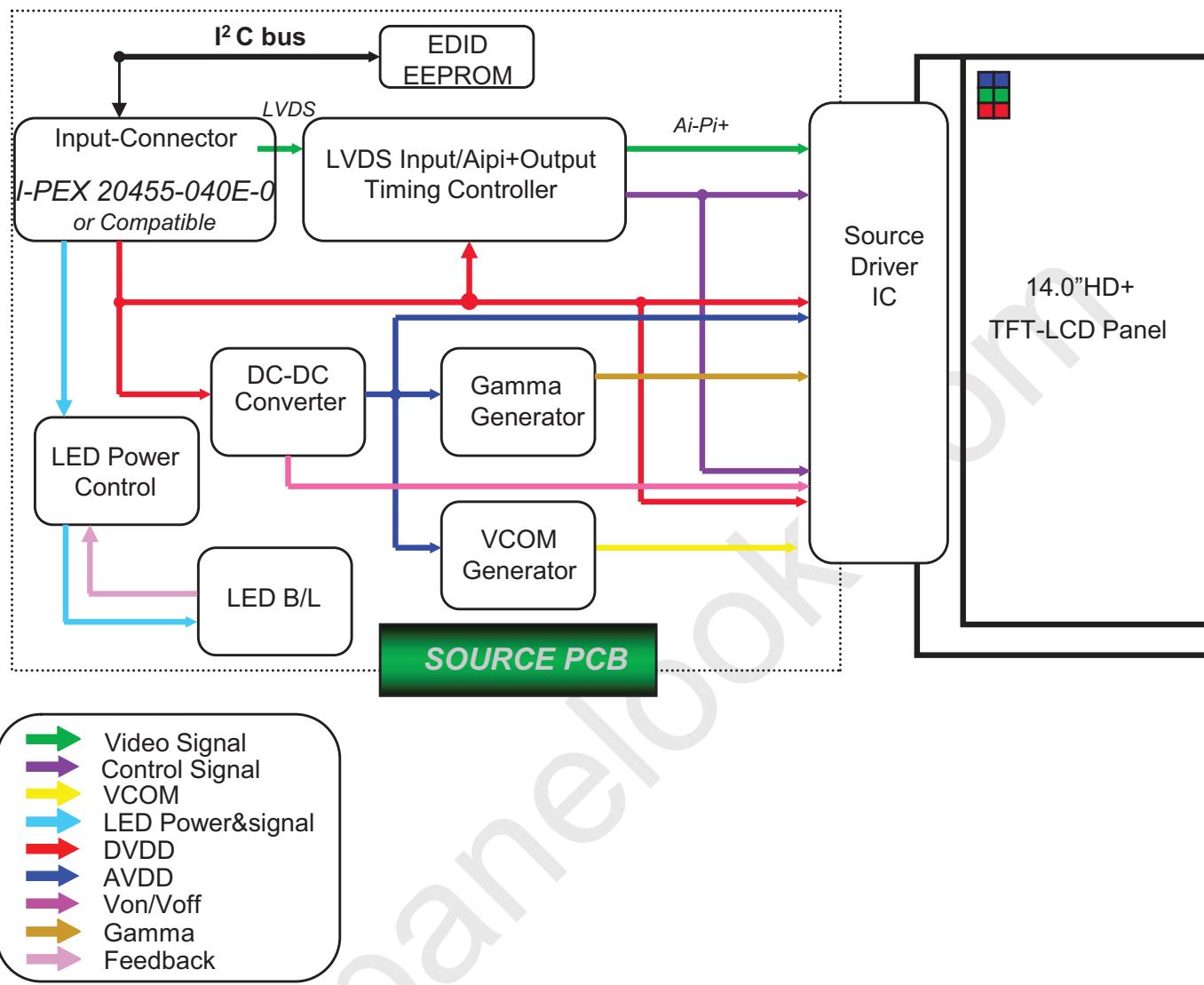
4.2 LED connection and placement

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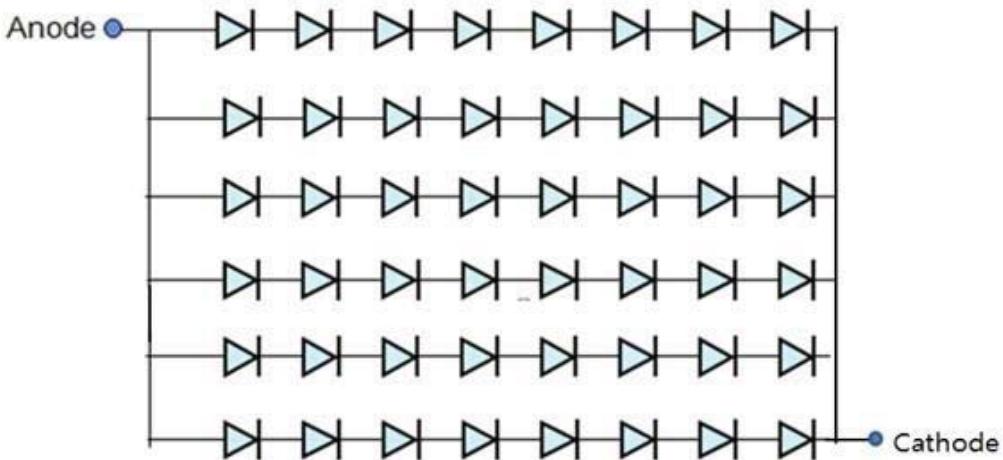
5. INPUT TERMINAL PIN ASSIGNMENT

5.1. Input Signal & Power (LVDS, Connector : IPEX 20455's or compatible)

No.	Symbol	Function	Polarity	Remarks
1	VDD	Power Supply 3.3V (typical)		
2	VDD	Power Supply 3.3V (typical)		
3	DE_EN	APS		
4	NC	No Connection		
5	CLK	LCD Internal Use		
6	DATA	LCD Internal Use		
7	Odd RIN0-	- LVDS differential data input (G0, R0-R5)	Negative	
8	Odd RIN0+	+ LVDS differential data input (G0, R0-R5)	Positive	
9	Odd RIN1-	- LVDS differential data input (B0-B1, G1-G5)	Negative	
10	Odd RIN1+	+ LVDS differential data input (B0-B1, G1-G5)	Positive	
11	Odd RIN2-	- LVDS differential data input (B2-B5, DE, VS, HS)	Negative	
12	Odd RIN2+	+ LVDS differential data input (B2-B5, DE, VS, HS)	Positive	
13	Odd CLK-	- LVDS differential clock input (Odd Clock)	Negative	
14	Odd CLK+	+ LVDS differential clock input (Odd Clock)	Positive	
15	Odd RIN3-	- LVDS differential data input (R6-R7, G6-G7, B6-B7)	Negative	
16	Odd RIN3+	+ LVDS differential data input (R6-R7, G6-G7, B6-B7)	Positive	
17	GND	Ground		
18	Even RIN0-	- LVDS differential data input (G0, R0-R5)	Negative	
19	Even RIN0+	+ LVDS differential data input (G0, R0-R5)	Positive	
20	Even RIN1-	- LVDS differential data input (B0-B1, G1-G5)	Negative	
21	Even RIN1+	+ LVDS differential data input (B0-B1, G1-G5)	Positive	
22	Even RIN2-	- LVDS differential data input (B2-B5, DE, VS, HS)	Negative	
23	Even RIN2+	+ LVDS differential data input (B2-B5, DE, VS, HS)	Positive	
24	Even CLK-	- LVDS differential clock input (Even Clock)	Negative	
25	Even CLK+	+ LVDS differential clock input (Even Clock)	Positive	
26	Even RIN3-	- LVDS differential data input (R6-R7, G6-G7, B6-B7)	Negative	
27	Even RIN3+	+ LVDS differential data input (R6-R7, G6-G7, B6-B7)	Positive	
28	GND	Ground		
29	PWM	PWM IN (SET → LCD)		
30	PWMO	PWM OUT (LCD → SET)		

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No.	Symbol	Function	Polarity	Remarks
31	GND	Ground		
32	FB6	LED Driver Feedback channel 6		
33	FB5	LED Driver Feedback channel 5		
34	FB4	LED Driver Feedback channel 4		
35	FB3	LED Driver Feedback channel 3		
36	FB2	LED Driver Feedback channel 2		
37	FB1	LED Driver Feedback channel 1		
38	GND	Ground		
39	VLED	LED Power Supply 35V (from SET)		
40	VLED	LED Power Supply 35V (from SET)		

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5. 2 LVDS Interface

5.2.1 LVDS DC Input

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
LVDS Differential Voltage	Vid	200	200	400	mV	
Input Common Mode Voltage	V_{CM}	0.4	1.2	1.6	V	
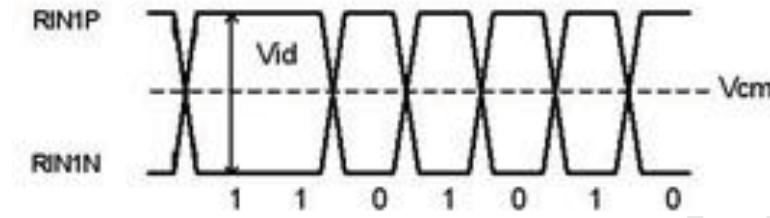
5.2.2 LVDS AC Input

ITEM		SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
LVDS input clock frequency		F_{CLK_LVDS}	20	-	100	MHz	
RIN skew margin	100 MHz	T_{RSRM}	-200	-	200	ps	(1),(2)
	50 MHz		-600	-	600	ps	(1),(2)
SSC Modulation Rate			-	-	±3	%	(3)
SSC Modulation Frequency			-	-	300	KHz	(3)

Note (1) : LVDS Receiver Skew (Strobe) Margin

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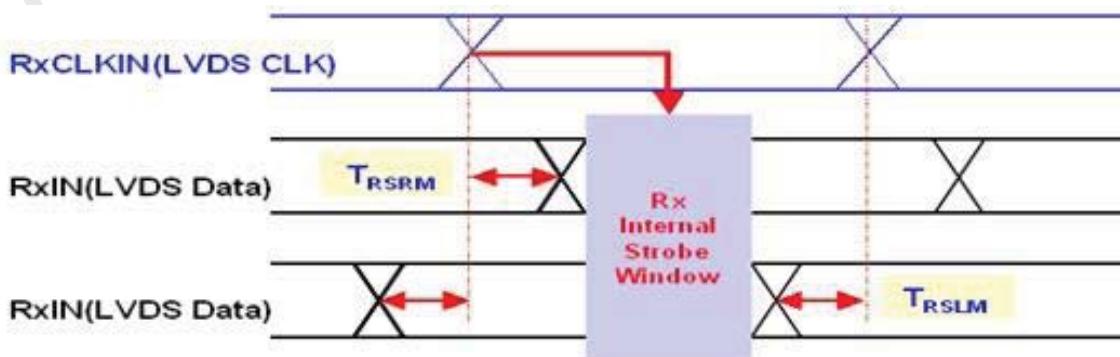
Note (2) : Ideal Strove Positions for LVDS Input
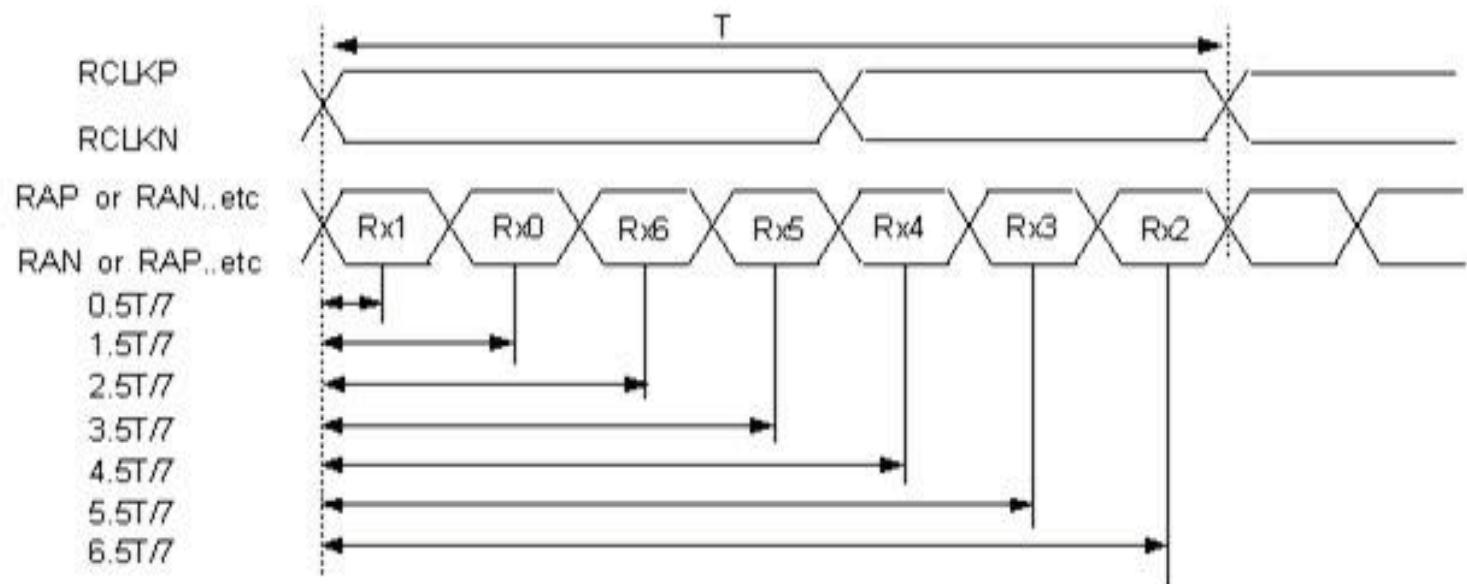
Note (3) : SSC (Spread Spectrum Clock)

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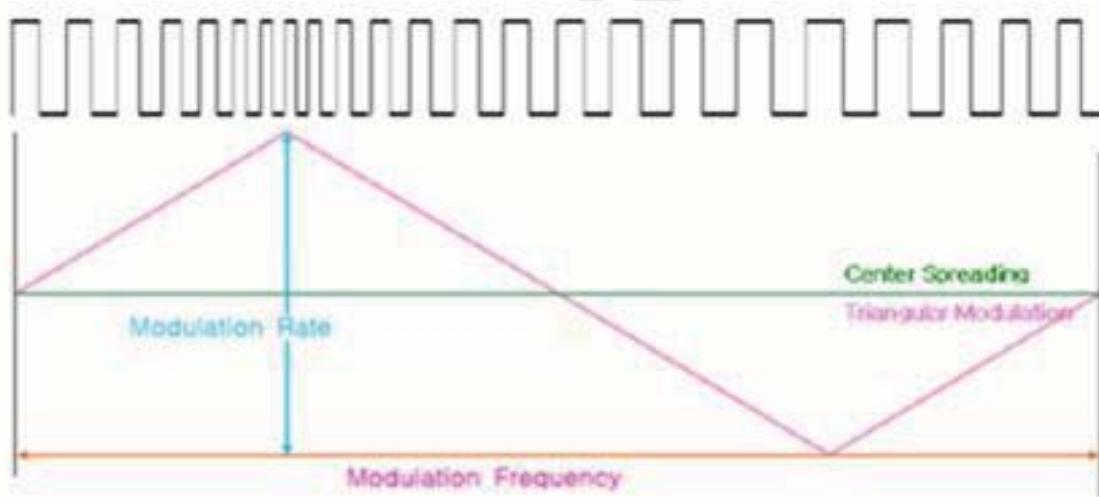
5.3 Timing Diagrams of LVDS For Transmission

LVDS Receiver : Integrated T-CON (8bit, NS Format)

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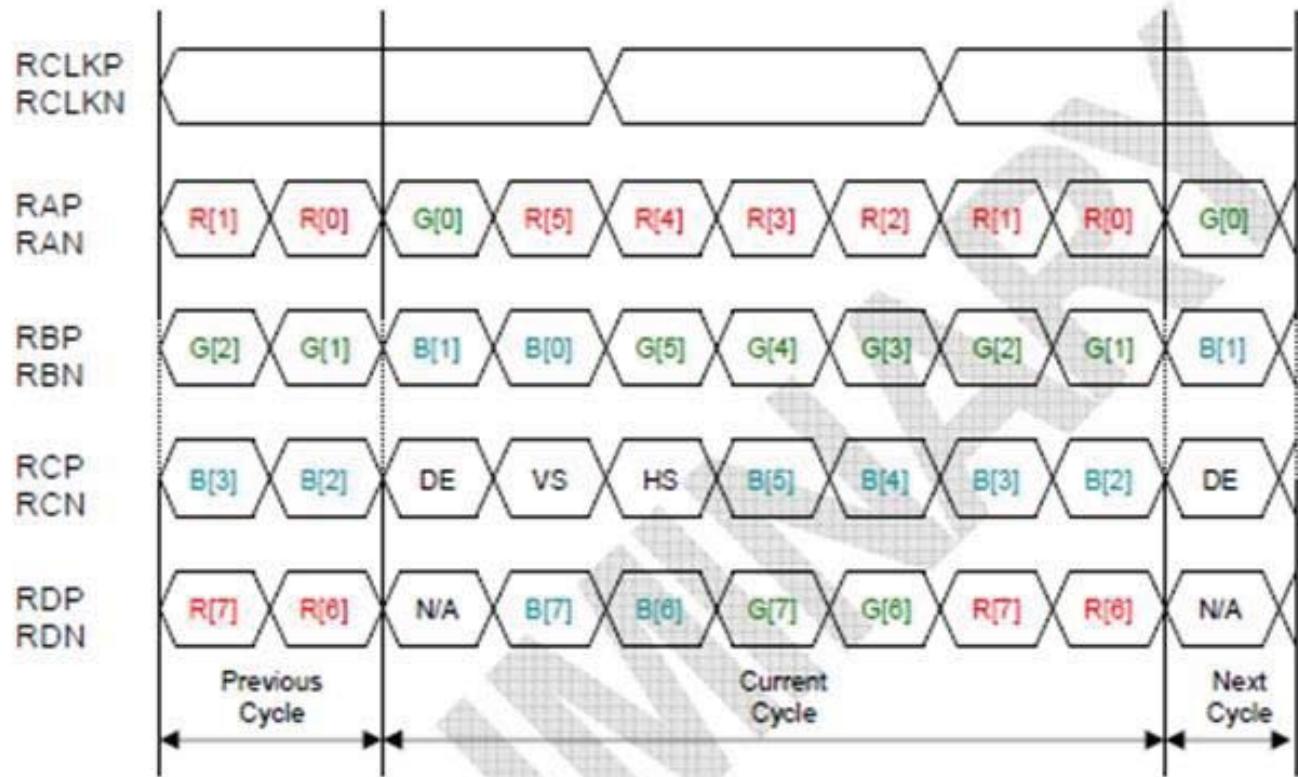
5.4 Input Signals, Basic Display Colors and Gray Scale of Each Color

color & gray Scale	R0	R1	R2	R3	R4	R5	R6	R7	G0	G1	G2	G3	G4	G5	G6	G7	B0	B1	B2	B3	B4	B5	B6	B7
Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Light Blue	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Purple	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
↕																								
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	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Red	1	1	1	1		1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
↕																								
	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Green	0	0	0	0	0	0	0	0	1	1	1	1		1	1	1	0	0	0	0	0	0	0	0
Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
↕																								
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1		1	1	1

Note 1) Definition of gray :
Rn: Red gray, Gn: Green gray, Bn: Blue gray (n=gray level)

Note 2) Input signal: 0 =Low level voltage, 1=High level voltage

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5.5 Pixel Format in the display
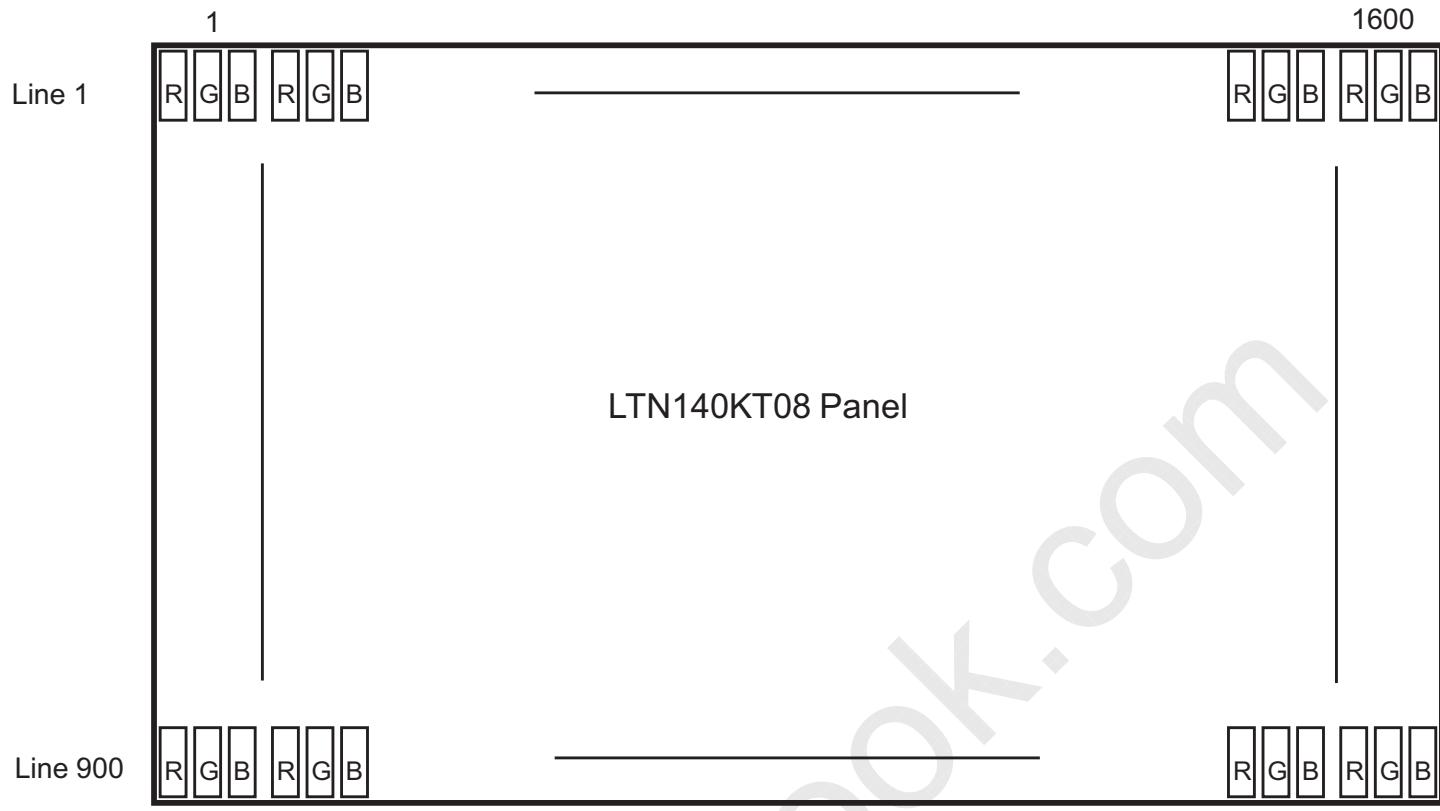
1   1600

Line 1   [R][G][B] [R][G][B]   [R][G][B] [R][G][B]

LTN140KT08 Panel

Line 900   [R][G][B] [R][G][B]   [R][G][B] [R][G][B]

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6. INTERFACE TIMING

6.1 Timing Parameters

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
Frame Frequency	Cycle	TV	900	930	1000	Lines	
Vertical Active Display Term	Display Period	TVD	-	900	-	Lines	
One Line Scanning Time	Cycle	TH	800	900	1069	Clocks	2ch
Horizontal Active Display Term	Display Period	THD	-	800	-	Clocks	2ch

6.2 Timing diagrams of interface signal
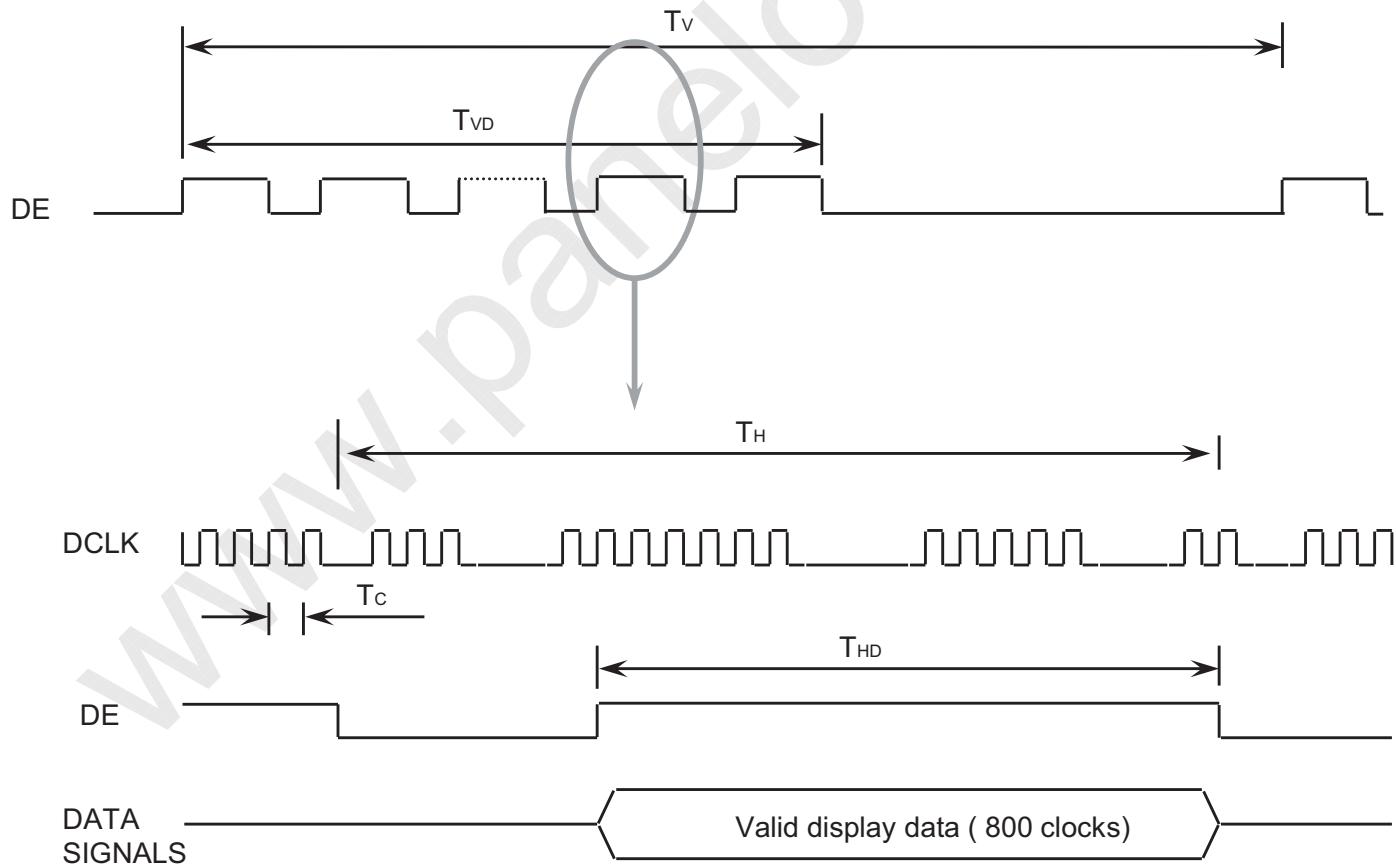
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6.3 Power ON/OFF Sequence

: To prevent a latch-up or DC operation of the LCD module, the power on/off sequence should be as the diagram below.
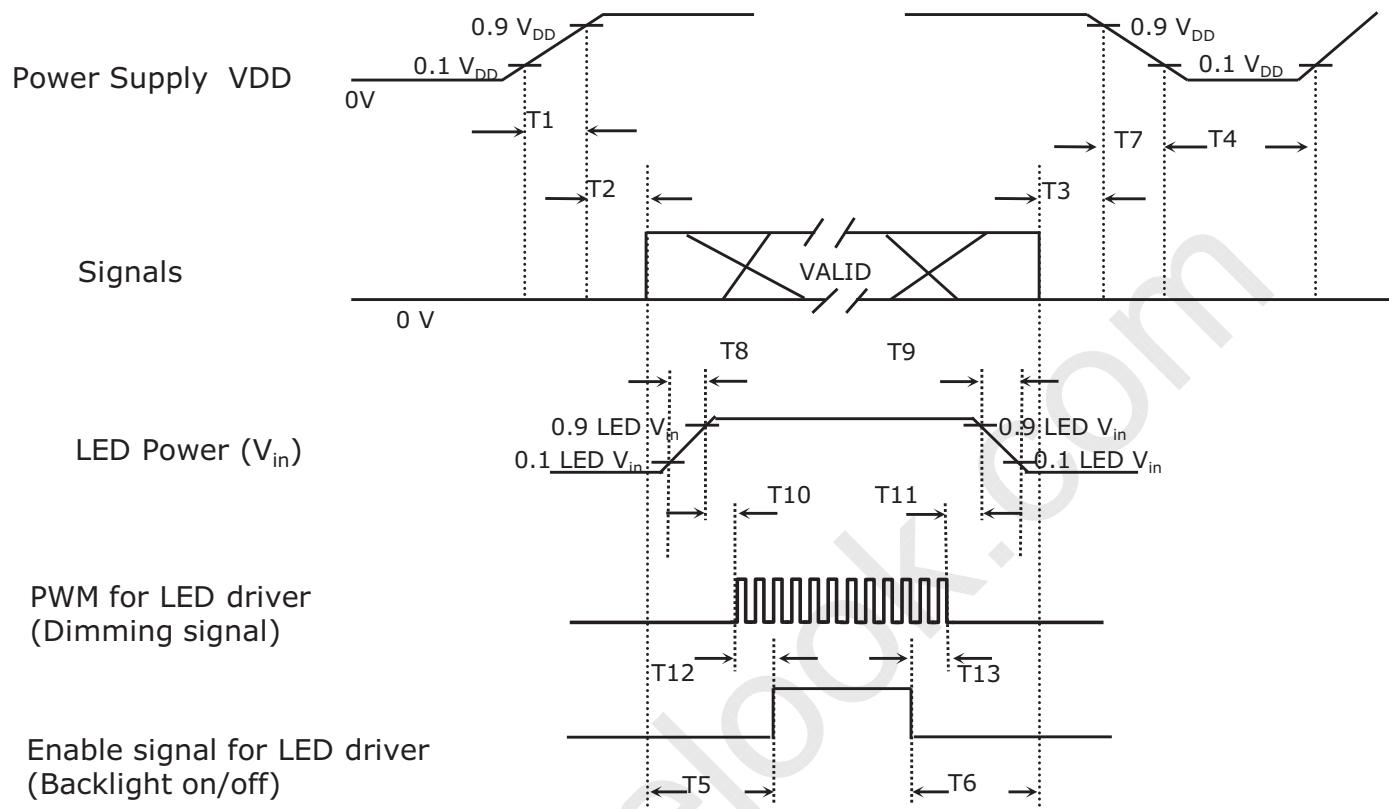
Power ON/OFF Sequence

Timing (ms)	Remarks
$0.5 < T1 \leq 10$	V_{DD} rising time from 10% to 90%
$0 < T2 \leq 50$	Delay from V_{DD} to valid data at power ON
$0 < T3 \leq 50$	Delay from valid data OFF to V_{DD} OFF at power Off
$500 \leq T4$	V_{DD} OFF time for Windows restart
$200 \leq T5$	Delay from valid data to B/L enable at power ON
$200 \leq T6$	Delay from valid data off to B/L disable at power Off
$0 < T7 \leq 10$	V_{DD} falling time from 90% to 10%
$0.5 < T8 \leq 10$	LED V_{in} rising time from 10% to 90%
$0.5 < T9 \leq 10$	LED V_{in} falling time from 90% to 10%
$0 \leq T10$	Delay from LED driver Vin rising time 90% to PWM ON
$0 \leq T11$	Delay from PWM Off to LED driver Vin falling time 10%, Must Keep rule
$0 \leq T12$	Delay from PWM ON to B/L Enable ON, Must Keep rule
$0 \leq T13$	Delay from B/L Enable Off to PWM Off

Power Sequence & Timing Parameters
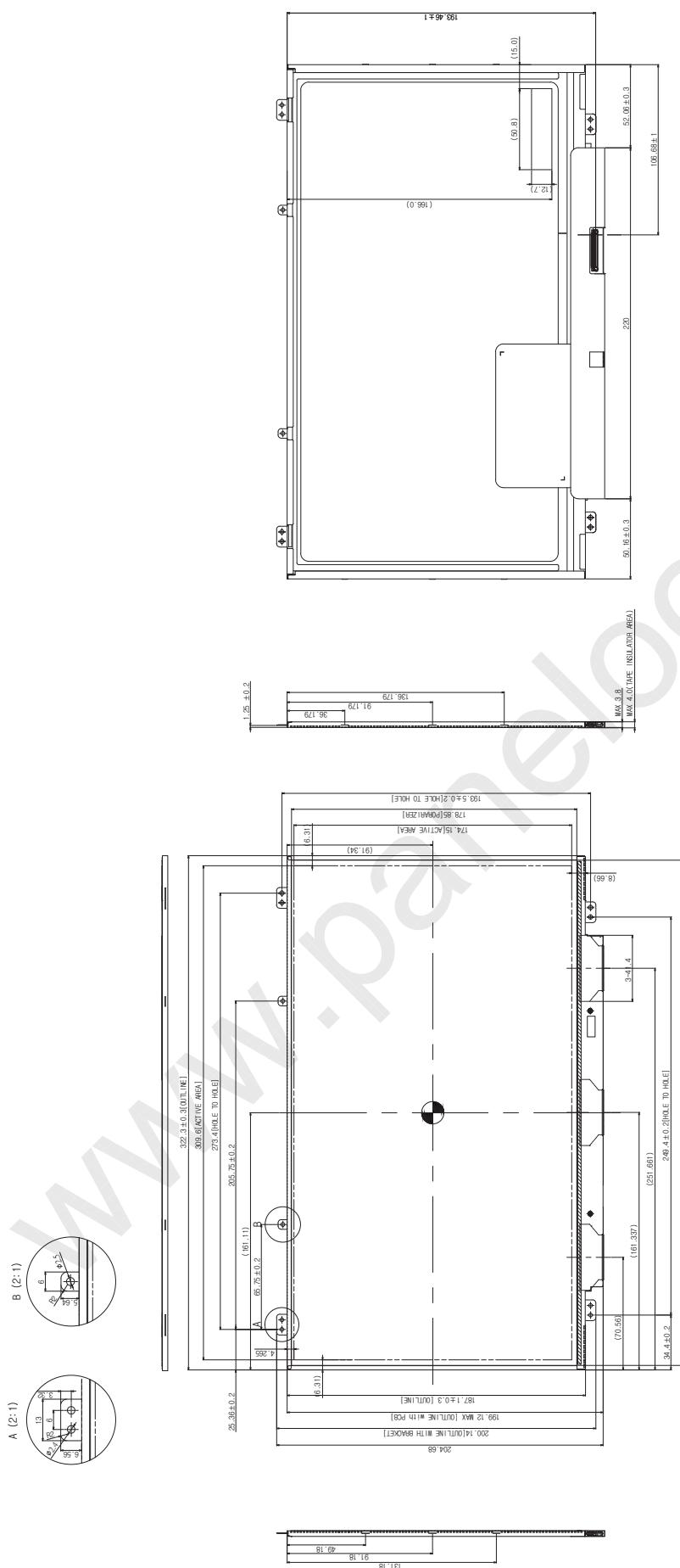
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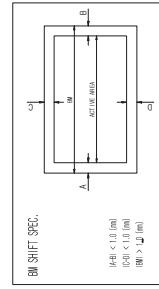
LTN140KT08-801

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8. PACKING

1. CARTON(Internal Package)

(1) Packing Form
     Corrugated Cardboard box and Corrupad form as shock absorber

(2) Packing Method

STEP 1. Putting into Zipper Bag

STEP 2. Putting on the paper tray

STEP 3. 2 Module / 1 Paper Tray

STEP 4. Folding the Paper Tray

STEP 5. Inserting at the Box

STEP 6. Putting the Top Pad

* included AL Bag in the outbox

* Note
- 2 Module / 1 Paper Tray
- 36 Module /1 Box
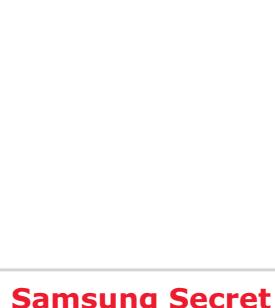
Note 1) Total Weight : Approximately 14kg

       2) Acceptance number of piling : 36 sets

       3) Carton size : 373(W) * 406(L) * 307(H)

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(3)Packing Material

No	Part name	Quantity
1	Static electric protective sack	36 pcs
2	Packing case	1 set
3	Pictorial marking	2 pcs
4	Carton	1 set

9. MARKINGS & OTHERS

A nameplate bearing followed by is affixed to a shipped product at the specified location on each product.

(1)Parts number : LTN140KT08
(2)Revision code : 3 letters
(3)Lot number   : X X X X XXX XX X   8**

SEC Revision Code

Panel number
Cell ID
Lot ID
Month
Year
Product Code
Line

(4) Nameplate Indication

LTN140KT08

SAMSUNG

1123

XXXXXXXXX   8**

USPXXXXXXX/USPXXXXXXX

MADE IN CHINA

40 mm

80 mm
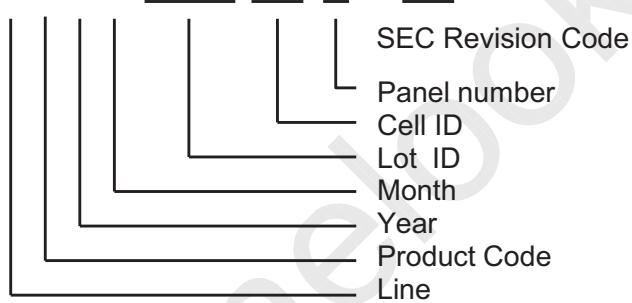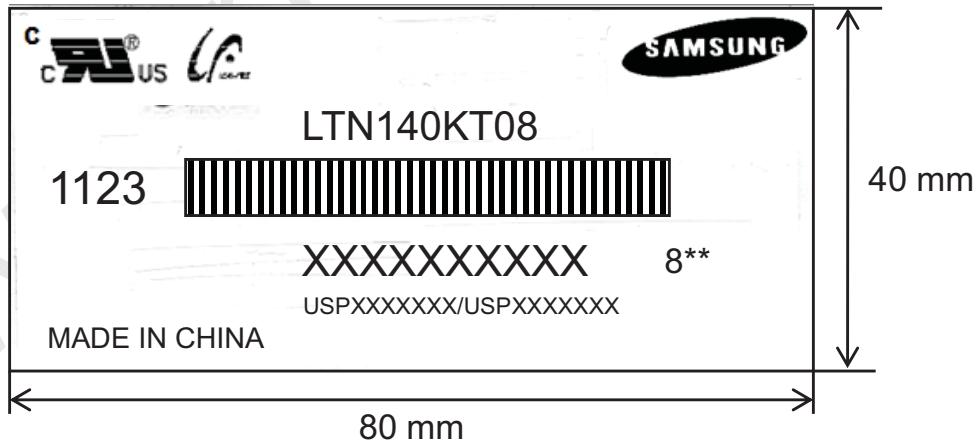
Parts name   : LTN140KT08
Lot number   : XXXXXXXXX
USPXXXXXXX/USPXXXXXXX : USP Related information Num.
Inspected work week   : 1123(20101year, 23th week)
Product revision Code   : 8**

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(5) Packing small box attach

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ELECTRONICS

DEVICE   : LTN140KT08
TYPE   : 8**
QUANTITY   : 36 PCS

CO6040001
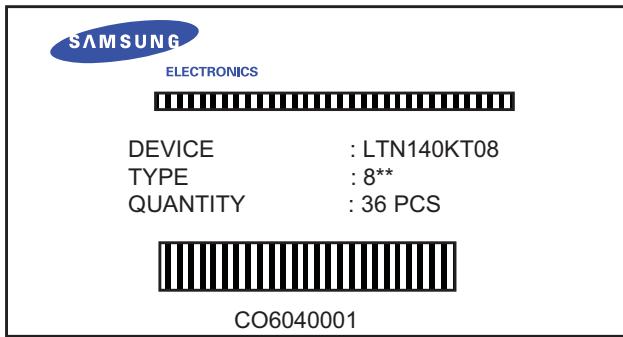
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10. GENERAL PRECAUTIONS

1. Handling

  (a) When the module is assembled, It should be attached to the system firmly
     using every mounting holes. Be careful not to twist and bend the modules.

  (b) Refrain from strong mechanical shock and / or any force to the module. In addition to
     damage, this may cause improper operation or damage to the module and LED back-light.

  (c) Note that polarizers are very fragile and could be easily damaged. Do not press or scratch
     the surface harder than a HB pencil lead.

  (d) Wipe off water droplets or oil immediately. If you leave the droplets for a long time,
     Staining and discoloration may occur.

  (e) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.

  (f) The desirable cleaners are water, IPA (Isoprophyl Alcohol) or Hexane.
     Do not use Ketone type materials(ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl
     chloride. It might permanent damage to the polarizer due to chemical reaction.

  (g) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or
     mouth . In case of contact with hands, legs or clothes, it must be washed away thoroughly
     with soap.

  (h) Protect the module from static , it may cause damage to the C-MOS Gate Array IC.

  (i) Use fingerstalls with soft gloves in order to keep display clean during the incoming
     inspection and assembly process.

  (j) Do not disassemble the module.

  (k) Do not pull or fold the lamp wire.

  (l) Do not adjust the variable resistor which is located on the back side.

  (m) Protection film for polarizer on the module shall be slowly peeled off just before use so
     that the electrostatic charge can be minimized.

  (n) Pins of I/F connector shall not be touched directly with bare hands.

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2. STORAGE
 We highly recommend to comply with the criteria in the table below.

ITEM	Unit	Min.	Max.
Storage Temperature	(℃)	5	40
Storage Humidity	(%rH)	35	75
Storage life	12 months		
Storage Condition	- The storage room should provide good ventilation and temperature control. - Products should not be placed on the floor, but on the Pallet away from a wall. - Prevent products from direct sunlight, moisture nor water; Be cautious of a build up of condensation. - Avoid other hazardous environment while storing goods. - If products delivered or kept in conditions of over the storage period of 3 months, the recommended temperature or humidity range, we recommend you leave them at a temperature of 20℃ and a humidity of 50% for 24 hours.		

3. OPERATION

(a) Do not connect,disconnect the module in the " Power On" condition.

(b) Power supply should always be turned on/off by following item 6.3
   " Power on/off sequence ".

(c) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.

(d) The standard limited warranty is only applicable when the module is used for general notebook applications. If used for purposes other than as specified, SEC is not to be held reliable for the defective operations. It is strongly recommended to contact SEC to find out fitness for a particular purpose.

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4. OTHERS

(a) Ultra-violet ray filter is necessary for outdoor operation.

(b) Avoid condensation of water. It may result in improper operation or disconnection of electrode.

(c) Do not exceed the absolute maximum rating value. (the supply voltage variation, input voltage variation, variation in part contents and environmental temperature, so on) Otherwise the module may be damaged.

(d) If the module displays the same pattern continuously for a long period of time,it can be the situation when the image "sticks" to the screen.

(e) This module has its circuitry PCB's on the rear side and should be handled carefully in order not to be stressed.

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Appendix A. MTBF Data

* MTBF for Panel

Sample Size — Acceleration Factor — Test time

$$MTBF = \frac{2 \times S/S \times AF \times Stress\ Hours}{Chisq(2r+2)\ @\ 90\%UCL}$$

r = fail size   Confidence level

※ Arrhenius Model : HTOL(55℃) AF=12.1

- Arrhenius equation

$AF = EXP (Ea/k * (1/Tu - 1/Ts))$
Tu : User Temp. Ts : Stress Temp.
Ea : Activation Energy
k : Boltzmann constant (= 8.617×10^{-5} eV)

※ HTOL data base.
※ Ea : Activation Energy (=0.7eV)
※ Confidence level : 60%
MTBF (Mean Time Between Failure) = 1/FR

[MTBF Simulation Result_Development stage]

Test item	Stress Temp.	Test Time	User Temp	AF	S/S	MTBF	remark
HTOL	55 ℃	500hr	25 ℃	12.1	12	31,532 hrs	-
Result	-	-	-	-	-	31,532 hrs	-

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Appendix B. Safety Approval

the standard in safety

Underwriters Laboratories

NOTICE OF AUTHORIZATION TO APPLY THE UL MARK

2011-10-07

Samsung Electronics Co Ltd
Mr. Kyoungjae Lee
200 Myeongam-ri
Tangjeong-myeon
Asan- Shi Chungcheongnam-do 336-841, Kr

Our Reference:	File E164704, Vol. X1 Project Number 11CA49342
Your Reference:	LEE, KYOUNGJAE MR.
Project Scope:	USR - Active Matrix Color TFT-LCD Module, LTN140&T** for E164704-A153-UL / LTN140KT08 / New,

Dear Mr. Kyoungjae Lee:

UL's investigation of your product(s) has been completed under the above Reference Number and the product was determined to comply with the applicable requirements.

This letter temporarily supplements the UL Follow-Up Services Procedure and serves as authorization to apply the UL Mark only at authorized factories under UL's Follow-Up Service Program.

To provide the manufacturer with the intended authorization to use the UL Mark, the addressee must send a copy of this notice to each manufacturing location currently authorized in File E164704, Vol. X1.

This authorization is effective from the date of this Notice and only for products at the indicated manufacturing locations. Records in the Follow-Up Services Procedure covering the product are now being prepared and will be sent in the near future. Until then, this letter authorizes application of the UL Mark for 90 days from the date of this letter.

Products that bear the UL Mark shall be identical to those that were evaluated by UL and found to comply with UL's requirements. If changes in construction are discovered, appropriate action will be taken for products not in conformance with UL's requirements and continued use of the UL Mark may be withdrawn. UL may elect to withdraw use of the UL Mark if the Applicant or Manufacturer fails to comply with UL's requirements including ongoing compliance of the product, under UL's Follow-Up Service.

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Notice of Authorization - 11CA49342

Any information and documentation provided to you involving UL Mark services are provided on behalf of Underwriters Laboratories Inc. (UL) or any authorized licensee of UL.

The contents of this Letter are intended solely for the use of UL and the Applicant. The opinions and findings of UL represent its judgment given with due consideration to the necessary limitations of practical operation in accordance with UL's objectives and purposes. UL shall not otherwise be responsible for the use of or reliance upon the contents of this letter by anyone. UL shall not incur any obligation or liability for any loss, expense or damages, including incidental, consequential or punitive damages, arising out of or in connection with the use or reliance upon the contents of this letter to anyone other than the Applicant as provided in the agreement between UL and Applicant. Any use or reference to UL's name or certification mark(s) by anyone other than the Applicant in accordance with the agreement is prohibited without the express written approval of UL.

Very truly yours,

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SEOE00D-26A3CF

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Appendix D. Image Sticking Test Result

SPL	시험조건								
	2hr	4hr	6hr	8hr	10hr	12hr	14hr	16hr	16hr 20min
SPL 1	1	1	1	2	2	2	2	2	1
SPL 2	1	2	2	3	3	3	3	3	1
SPL 3	1	2	2	2	2	2	2	2	1
SPL 4	1	2	2	2	3	3	3	3	2
SPL 5	1	2	2	2	2	2	2	2	1
SPL 6	1	1	1	1	1	2	2	2	1
SPL 7	1	1	1	2	2	2	2	2	1
SPL 8	1	2	2	3	3	3	3	3	2
SPL 9	1	1	1	2	2	2	2	2	1
SPL 10	1	1	1	2	2	2	2	2	1

Appendix E. Pogo Test Result

구분	8kgf	9Kgf	10Kgf	11kgf	12kgf	13Kgf	14kgf	15kgf
SPL1	1	1	1	2	2	2	2	2
SPL2	1	1	1	1	2	2	2	2
SPL3	1	1	1	1	2	2	2	2

Appendix F. EE Noise Test Result

LED Driver 외장으로 Dimming 평가 미실시			LTN140KT08		
			SPL 1	SPL 2	SPL 3
1DOT	Active	전주파수	12	11.7	11.8
		가청주파수	5.2	5	5
	PCB	전주파수	11.7	12	12
		가청주파수	6.8	7.8	7.2
WHITE	Active	전주파수	11.8	11.9	11.7
		가청주파수	5.1	5	5.1
	PCB	전주파수	11.6	11.9	11.6
		가청주파수	6.8	7.1	6.8
NEC	Active	전주파수	11.7	11.6	12.1
		가청주파수	5	5.2	5.1
	PCB	전주파수	11.7	12	11.9
		가청주파수	6.4	7.5	6.9

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Appendix G. Key Part List

				CS sample
일반 사양			MOD Line	Radiant
			OLB Site	Tangjung
			Resolution	1600*900
			Color Depth	45%
			Brightness	300nit (Typ), 255nit (min)
			Contrast Ratio	500 : 1 Typ.
			Viewing Angle	45/45/15/30
			Weight(typ)	330g Max
			Outline	322.3 x 187.1
			Thickness	3.8 max (PCB Cover 부분 4.0max)
Cell	Glass		Technology	MB6/ ASG2
			FAB	L6
			Mask Number	4 MASK
			Thickness (mm)	0.5
	Polarizer	Front	Maker	Koreno
			Type/Model	NPF-TEGQ1466DU AG470
		Surface Treatment	Coating	AG
			Wide View Film	–
		Rear	Maker	Cheil Industries
			Type/Model	AMN-0246 AG25
	LC		Maker	MERCK
			Type/Model	MAT-09-2122
			액정/Pixel 구조	ATN7/T3++
			Response time (ms)	16
			Voltage(V)	3.0V
	Drive method of inversion			Column
Elec	T-con		Maker	Magna
			Type/Model	FBGA / LPM70G4(Alice)
			Voltage(V)	2.5V
			T-con→Source Driver IC	AiPi
	Source	PCB	Maker	GCE, TPT
			Material	FR4(MIDDLE TG)
			Layer	10
			PCB Rev. code	V0.4
		Driver	Maker	COF
			Type/Model	DB7691A-FS11M
			output pin	960
			Input Voltage (V)	3.3
	Gate		Maker	Gateless
	LED controller		Maker	External LED
			Type/Model	–
Back Light	LED		Maker	Samsung LED
			Quantity.	48ea
			Qty (strings x LEDs)	6X8
			LED current (mA)	External LED Driver
			LED 광도(Typ)	2.2cd
			LED assembly maker	NEONIX
	FPC		Maker	UFKS
	Diffuser	Upper	Maker/Type	-
		Lower	Maker/Type	CH14NH 0.12T
	Prism sheet	Upper	Maker/Type	MAS517ASF1 0.21T
		Lower	Maker/Type	H505A.T0.16
	Light Guide Plate		Maker/Type	PMMA, 0.7T
			Pattern	Injection
	Reflector Sheet		Maker/Type	E6SR225 0.225T
	Backlight Assembly Maker			Radiant

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Appendix H. Impedance Test Result

구분	SPL 2매
Waveform	
Average	77.76ohm
Spec	100ohm±20%

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